WHAT IS CLAIMED IS:

1. A semiconductor optical amplifier comprising:

a substrate;

a first gain section, disposed on said substrate, for providing a first gain to an optical signal, wherein said first gain has a first transverse electric (TE) component and a first transverse magnetic (TM) component, and a magnitude of said first TE component is greater than a magnitude of said first TM component; and

a second gain section, disposed on said substrate adjacent to said first gain section, for providing a second gain to said optical signal, wherein said second gain has a second TE component and a second TM component, and a magnitude of said second TM component is greater than a magnitude of said second TE component.

2. The semiconductor optical amplifier of claim 1, wherein said first and second gain sections are fabricated using one of quantum well materials and bulk materials.

3. The semiconductor optical amplifier of claim 1, wherein said first and second gain sections receive substantially the same drive current and have substantially the same length.

4. The semiconductor optical amplifier of claim 1, further comprising a residual

cladding layer disposed above said first and second gain section, wherein said residual cladding layer has a first thickness over said first gain section and a second thickness over said second gain section, said first thickness being different than said second thickness.

5. The semiconductor optical amplifier of claim 4, wherein said first thickness is less than said second thickness.

6. The semiconductor optical amplifier of claim 5, wherein said first thickness is 0.3 micrometers or more and said second thickness is 0.4 micrometers or less.

7. The semiconductor amplifier of claim 1, wherein a boundary between said first gain section and said second gain section is positioned at an angle to reduce reflections at the interface.

8. The semiconductor amplifier of claim 1, wherein the first gain section and the second gain section are connected by a passive waveguide.

9. The semiconductor amplifier of claim 8, wherein a mode transformation from active waveguides in the first and second gain sections to a passive waveguide connecting the first and second gain section employs a resonantly coupled set of active and passive waveguides.

10. The semiconductor optical amplifier of claim 1, wherein a first difference between said magnitude of said first TM component and said magnitude of said first TE component is substantially similar to a second difference between said second TM component and said second TE component, whereby an overall gain of said semiconductor optical amplifier is substantially polarization independent.

11. The semiconductor optical amplifier of claim 10, wherein said first difference and said second difference are about 5 dB.

12. A semiconductor optical amplifier comprising:

substrate means for integrating elements of said semiconductor optical amplifier thereon;

first gain means, disposed on said substrate, for providing a first gain to an optical signal, wherein said first gain has a first transverse electric (TE) component and a first transverse magnetic (TM) component, and a magnitude of said first TE component is greater than a magnitude of said first TM component; and

second gain means, disposed on said substrate adjacent to said first gain means, for providing a second gain to said optical signal, wherein said second gain has a second TE component and a second TM component, and a magnitude of said second TM component is greater than a magnitude of said second TE component.

13. The semiconductor optical amplifier of claim 12, wherein said first and second

gain means are fabricated using one of quantum well materials and bulk materials.

14. The semiconductor optical amplifier of claim 12, wherein said first and second gain means receive substantially the same drive current and have substantially the same length.

15. The semiconductor optical amplifier of claim 12, further comprising a residual cladding layer disposed above said first and second gain means, wherein said residual cladding layer has a first thickness over said first gain means and a second thickness over said second gain means, said first thickness being different than said second thickness.

16. The semiconductor optical amplifier of claim 15, wherein said first thickness is less than said second thickness.

17. The semiconductor optical amplifier of claim 16, wherein said first thickness is 0.3 micrometers or less and said second thickness is 0.4 micrometers or more.

18. The semiconductor amplifier of claim 12, wherein a boundary between said first gain section and said second gain section is positioned at an angle to reduce reflections at the interface.

19. The semiconductor amplifier of claim 12, wherein the first gain section and the second gain section are connected by a passive waveguide.

20. The semiconductor amplifier of claim 19, wherein a mode transformation from active waveguides in the first and second gain sections to a passive waveguide connecting the first and second gain section employs a resonantly coupled set of active and passive waveguides.

21. The semiconductor optical amplifier of claim 12, wherein a first difference between said magnitude of said first TM component and said magnitude of said first TE component is substantially similar to a second difference between said second TM component and said second TE component, whereby an overall gain of said semiconductor optical amplifier is substantially polarization independent.

22. The semiconductor optical amplifier of claim 21, wherein said first difference and said second difference are about 5 dB.

23. A semiconductor optical amplifier comprising:

a substrate;

a gain section, provided on said substrate, for providing gain to an input optical signal; and

a residual cladding layer provided on said gain section, said residual cladding layer having a first thickness over a first portion of said gain section and a second thickness over a second portion of said gain section, said first thickness being different than said second thickness.

24. The semiconductor optical amplifier of claim 23, wherein said gain has a first transverse electric (TE) component and a first transverse magnetic (TM) component over said first portion of said gain section, a magnitude of said first TE component is greater than a magnitude of said first TM component; and

wherein said gain has a second TE component and a second TM component over said second portion of said gain section, a magnitude of said second TM component is greater than a magnitude of said second TE component.

25. The semiconductor optical amplifier of claim 23, wherein said gain section is fabricated using one of quantum well materials and bulk materials.

26. The semiconductor optical amplifier of claim 23, wherein said first and second portions of said gain section receive substantially the same drive current and have substantially the same length.

27. The semiconductor optical amplifier of claim 23, wherein said first thickness is less than said second thickness.

28. The semiconductor optical amplifier of claim 27, wherein said first thickness is 0.3 micrometers or more and said second thickness is 0.4 micrometers or less.

29. The semiconductor amplifier of claim 23, wherein a boundary between said first portion of said gain section and said second portion of said gain section is positioned at an angle to reduce reflections at the interface.

30. The semiconductor amplifier of claim 23, wherein the first portion of said gain section and the second portion of said gain section are connected by a passive waveguide.

31. The semiconductor amplifier of claim 30, wherein a mode transformation from active waveguides in the first and second portions of said gain section to said passive waveguide connecting the first and second portions of said gain section employs a resonantly coupled set of active and passive waveguides.

32. The semiconductor optical amplifier of claim 23, wherein a first difference between said magnitude of said first TM component and said magnitude of said first TE component is substantially similar to a second difference between said second TM component

and said second TE component, whereby an overall gain of said semiconductor optical amplifier is substantially polarization independent.

33. The semiconductor optical amplifier of claim 32, wherein said first difference and said second difference are about 5 dB.

34. A method for amplifying an optical signal comprising the steps of:

providing a gain section on a substrate;

providing, on a first portion of said gain section, a residual cladding layer having a first thickness;

providing, on a second portion of said gain section, a residual cladding layer having a second thickness, said first and second thicknesses being different from one another;

amplifying said optical signal in said first portion of said gain section to generate an amplified optical signal having a transverse electric (TE) component which is greater than a transverse magnetic (TM) component;

amplifying said amplified optical signal in said second portion of said gain section to generate a substantially polarization independent output optical signal.

35. The method of claim 34, further comprising the step of:

fabricating said gain section using one of quantum well materials and bulk materials.

36. The method of claim 34, further comprising the step of :

driving said first and second portions of said gain section with substantially the same drive current.